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HOT WEATHER CLOTHING

By Dr. Edwin E. Slosson.

In these days when we are largely occupied in efforts to keep cool, it is worth while to spend a little thought on the fundamental principles of heat movement and how we can apply them to the problem.

In the first place we must remember that our object is not so much to keep the heat out as it is to get the heat out. Our internal stoves, where food serves as fuel, produce heat enough to raise us to the fever point in a few hours and to cause death by what is commonly called "sunstroke", even though there were no sun, if we could not continually pass off our surplus heat to the surrounding air.

The air will consent to relieve us of our surplus heat on two conditions: first, when the air is cooler than our bodies, and, second, when it has less water than it can hold. If the air is above 99 degrees Fahrenheit and has 100 per cent humidity, there is no help for us.

Fortunately the air roundabout rarely attains these two conditions, but the air that is kept in contact with the skin as by tight or thick clothing does get to the same temperature as the body and does take up all the moisture it can hold. In that case the only thing to do is to get rid of this old air and get in some new that is capable of absorbing heat and perspiration.

From a purely theoretical point of view, therefore, the ideal midsummer costume would be to wear a large umbrella and nothing else. But to apply a scientific theory without regard to local circumstances is often unwise and sometimes unsafe. Yet whatever deviation from the ideal local custom may require, we should bear in mind the fundamental principle that cooling is due chiefly to evaporation and that evaporation depends upon ventilation. Close clothing keeps a hot and humid layer of air in contact with the skin so that we who rejoice that we dwell in the temperate zone are really living the year round in a tropic atmosphere except for our hands and face. The circulation of air should theoretically, be sufficient to keep the skin free from uncomfortable accumulation of perspiration, but not so rapid as to chill it by excessive evaporation. It is not the sweat we see that cools us but that which passes off unperceived. To evaporate the water from a man's wet clothing may require as many calories as he gets in a day's food.

Clothing halves the loss of heat in cold weather and cuts it down still more in warm weather. The clothed man ranks between the furry dog and the rabbit in

the matter of heat exchange.

If our skin were a sheet of silver foil of the same thickness, we would lose heat 2280 times as fast as we do, but a layer of immobile air, such as may be caught by fur, feathers, or close-knit cloth, will retard the loss of heat ten times as much as the skin.

To keep the air in free circulation over the skin, the clothing should touch the skin as little and as lightly as possible. Coarse meshed and porous fabrics are better than fine cloth.

The weave makes more difference than the color. It is true that black clothing absorbs about twice as much sunlight as white, but that does not tell the whole story, for it is heat that we want to keep out, and more than half of the sun's heat is not seen by the eye as light. We see about an octave of the solar spectrum, from the red waves of lowest frequency to the violet of highest frequency. But beyond the violet there are two octaves and below the red there are six octaves that we can not perceive with the eye. At high noon in the latitude of Washington, 51 per cent of the energy of solar radiation comes in the form of the dark heat rays of the infra-red, 40 per cent as visible light, and 9 per cent as ultra-violet rays, also invisible but the most powerful of all in their effect on the skin. It is the ultra-violet rays that are responsible for tanning and burning. Now the dark heat rays pass equally well through dark and light cloth, and the ultra-violet chemical rays pass better through light than dark.

Leonard Hill, the great English authority on climatology, commends the Egyptian robes as the most comfortable garments for a hot country for "as the native walks his garments sway and flap in ungainly fashion, but in doing so cause air currents, which have a cooling effect". The missionaries' wives, when called upon to devise a costume for the women of the Pacific Islands, did well from a sanitary point of view when they clothed them in Mother Hubbards, though they could hardly have done worse from an artistic point of view.

But it is not necessary for clothing to be unbecoming in order to be comfortable. Probably American women have never been more seasonably clad than they are this summer, but no one could call their costumes ungainly. The men, too, although they are more conservative and less original than women in matters of dress, have made some progress of late in the adaptation of their clothing to the summer season, but their tight collars and belts are contrary to the first principles of hot weather costume.

HOW ASTRONOMERS WILL OBSERVE MARS AT CLOSEST APPROACH

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Mars will approach closer to earth on August 22 than it has in the past hundred years or will in the next hundred. This ruddy planet, now visible late in the evening as a very bright object low down in the southeastern sky, has been the subject of much speculation in past years, particularly as to whether it supports intelligent life capable of constructing so-called "canals" which have been described by prominent observers of Mars.

At this favorable opposition Mars will be only 34,630,000 miles away from

earth.

Leading observatories throughout the country have announced their plans for astronomical observations during the time of this visit of Mars close to the earth.

EXTENSIVE PROGRAM PLANNED AT LOWELL OBSERVATORY

Flagstaff, Ariz.- At the Lowell Observatory, which has followed closely and observed carefully every opposition of Mars since 1894, a program of observations has been under way for some weeks, according to Dr. E. C. Slipher, director. The methods of observations used at this observatory at past approaches of the planet will be continued with added refinements, while newer methods of observation and instrumental equipment are to be employed in new fields of investigation.

"The size and density of Mars, its position and motion with regard to the sun and the length and character of its seasons as well as the length of its day have long been known with satisfactory accuracy," Dr. Slipher said. "Now the chief objects of observation are to determine the physical conditions existing on the planet. The aim is to learn more of the extent, density, and constitution of the atmosphere; the constitution of the polar caps; the determination of the planet's surface temperature; a further knowledge of seasonal changes and the nature and cause of the change in the dark markings or 'canals'.

"It is planned here to make visual observations with the 24-inch refractor telescope depicting the markings, polar caps and other features in drawings supplemented by notes and measures with the micrometer. These are intended to detect changes and trace out their cause. In particular the visual study will include observations and measures of well known markings to determine their position in Martian latitude and longitude. Measurements of salient points on the disk will also serve to check the adopted position of the axis about which Mars turns every 24 hours and 37 minutes.

"Large scale telescopic photographs of the planet will be taken at the same time to supplement the visual work. The photograph is more efficient in the exact rendering of tone and intensity of markings and their relative positions, and gives trustworthy confirmation to visual observations. The photographic record of the planet secured here, now extending back twenty years, is of great value in the study of this planet. Moreover, extended and systematic photographic record of the planet will provide comparable and incontestable material for future study of Martian changes and their interpretation.

"Photometry of the planet's surface will be carried out in order to measure the relative brightness of different parts of the surface and the character of the variations of the brightness of the markings.

"Large scale photographs will also be made with the 40-inch reflector, employing color sensitive plates exposed through different colored filters so as to measure the color values of the different markings. These should give valuable information on the nature of the markings and the changes taking place there. Observations of the spectrum of the planet will be carried out.

"In order to further the knowledge of the surface temperature on Mars, a

radiometer or sensitive heat measuring instrument will be used on the 40-inch reflecting telescope to measure the heat energy emitted by the surface of the planet.

"While it is true that Mars will shine forth from our southern sky this summer the biggest and brightest he ever appears to dwellers on the earth, yet I fear most persons greatly over estimate the scientific value of this once-in-two-hundred year view of him. Since we cannot see forthright in the telescope the exact nature of what exists on any of our planets, but arrive at these facts by more or less indirect means, the value of observations is not entirely dependent upon or commensurate with nearness of view. For this reason, observations made at the exact time of nearest approach of the planet do not have an important advantage over those made on many nights before or after that date. Because we can not watch the progressive development of the markings throughout any single Martian year, our knowledge of him must be gained chiefly by correlating and piecing in the observations of different seasons of different years. For these reasons a few observations of the planet when nearest the earth are not likely to add much if anything to the exact knowledge of it, unless some highly informative phenomenon should obligingly chance to appear during that brief study."

SATELLITES OF MARS TO BE STUDIED BY NAVAL OBSERVATORY

Washington, -- The two satellites or moons of Mars will occupy the attention of astronomers of the U. S. Naval Observatory, at the time of the favorable opposition of Mars in August, Capt. Edwin T. Pollock, U.S.N., superintendent of the observatory, has announced.

Phobos and Deimos, the two satellites, were discovered at this observatory by Dr. Asaph Hall, sr., in 1877.

"They are small and faint objects, the inner, Phobos, perhaps 36 miles, and the outer, Deimos, perhaps 10 miles in diameter," Capt. Pollock explained. "When they are at elongation, that is farthest away, apparently, from the planet, these moons can be seen with moderate sized telescopes by putting Mars out of the field. The Greenwich times of elongation can be taken from the American Ephemeris.

"The observations of the moons furnish among other data the mass of the planet. The inner satellite, Phobos, is only 3680 miles from the surface of Mars. It can not be seen from the regions about the planet's poles.

"From the equator of Mars Phobos, in the zenith, might appear as large as the Earth's moon.

"On account of its short period of revolution Phobos rises in the west, passes eastward across the sky, and sets in the east, making more than 3 revolutions while Mars is turning once on its axis. The short period of Phobos raises curious questions as to the theory of the development of the solar system.

"The period of Phobos from meridian to meridian is 11 hours, that of the outer moon, 14,000 miles from Mars, Deimos, is 131 hours. This is more than four of the months of Deimos, which therefore goes through all its changes of phase four time during this interval."

MT WILSON TO MEASURE HEAT FROM MARS

Pasadena, Calif.-

The largest telescope in the world, the 100-inch reflector at Mount Wilson Observatory here, will be turned upon Mars at the time of its closest approach to earth in August, if conditions are favorable, Dr. Walter F. Adams, of that institution says. It is probable that photographic plates sensitive to red light will be used in order to detect differences in the kind of light from different parts of the surface. Measurements of the heat radiated from the polar caps and other portions of the surface will also be made.

ASTRONOMER-ARTIST TO OBSERVE AT YERKES OBSERVATORY

Williams Bay, Wis. - When conditions are highly favorable for the observation of Mars, Prof. George Van Biesbroeck, an experienced artist, will make drawings of that planet, using the Yerkes Observatory forty-inch telescope, Dr. Edwin B. Frost, director of the Observatory, has announced. Owing to the low altitude of Mars in the sky and the consequently poor observing conditions at the time of opposition no photographic observations are planned.

"At the succeeding opposition when the altitude is more favorable and when special apparatus can be designed by Prof. Frank E. Ross who will then be here, we shall secure photographs," Dr. Frost said.

SPECIAL LIGHT SENSITIVE PLATES TO CATCH MARS AT LICK OBSERVATORY

Mount Hamilton, Calif. - Photographic observations of Mars with special plates and color filters will be made during the next month, Dr. R. G. Aitken, assistant director of Lick Observatory, announced.

"Specially prepared plates sensitive to ultra violet and red light as well as light to which ordinary photographic plates are sensitive, will be exposed through the Crossley reflecting telescopes," Dr. Aitken explained. "Light with wave-lengths of 7500, 4500, and 3600 Angstrom units will be utilized. Orthochromatic plates and color filters using light of wave length of 5000 Angstrom units will be used in connection with the 36-inch refracting telescope."

Positions of the satellites of Mars will be measured and the planet will be watched visually as occasion offers

HARVARD ASTRONOMERS IN JAMAICA PLAN VISUAL OBSERVATIONS OF MARS

Cambridge, Mass. - An extensive program of intensive visual observations of Mars with the Draper telescope will be carried on in August by Prof. W. H. Pickering and his assistants at the Mandeville, Jamaica, station of the Harvard College Observatory. Dr. Harlow Shapley, director of the Harvard College Observatory, announces that no plans have been made for the observation of Mars at the Arequipa or Cambridge stations.

Pittsburgh, Pa. - "Mars will be a little closer to the earth on August 22 than at any recent opposition period but the advantage gained is very slight, only about one per cent." says Dr. H. D. Curtis, director of Allegheny Observatory. "Unfortunately, it will also be 18 degrees south of the celestial equator and thus unfavorably situated for observers in the northern United States. No extensive program of observations is being planned at Allegheny Observatory though some photographs may be attempted."

Swarthmore, Pa. - No extensive program for observing Mars is contemplated at the Sproul Observatory, according to Dr. John A. Miller, director. Some drawings and photographs of the planet will be made at the time of its closest approach in August.

READING REFERENCE - Gregory, Sir Richard. The Vault of Heaven. New York, E. P. Dutton & Company, 1923.

GRAFTED POTATOES GROW LIKE FRUIT

Grafting, a procedure quite common in tree culture, has been applied to vegetables and flowers by a French botanist who has by this method increased the size and yield, created new species, prolonged the life of plants and intensified the perfume of flowers.

Prof. Lucien Daniel of the University of Rennes has performed grafting operations on cabbage, lettuce, beans, potatoes, tomatoes and various flowers. Other botanists who have examined his results concede that the fantastic experiments made by Prof. Daniel hold much practical promise for the market gardener.

One of the first attempts made by Prof. Daniel was to graft the black Belgian bean on a large white Soissons bean. From this combination plant he obtained seeds of an entirely new variety of beans which has remained fixed.

He took a bitter variety of cabbage unfit for food but which resists frosts and grafted on it a variety that has a good flavor but succumbs easily to cold. The seeds of the hybrid yielded a new variety that tastes good and resists cold.

Some of his most sensational grafts were made on the family Solanaceae to which belong such useful plants as potatoes, tomatoes, tobacco, and egg plant. He grafted sections of egg plant on tomato vines. First the grafts produced the regular ovoid egg plant fruit and later on the same branch yielded other fruit resembling that of tomatoes. Finally a true hybrid, round in shape, was obtained.

Prof. Daniel has also grafted tomato branches and bella donna on potato vines and potato stems on egg plants and tomato vines. Potatoes, of course, are simply swollen stems or tubers which develop underground. He was curious as to what would happen when he grafted a potato stem on another plant. Would tubers continue to be produced? Yes, they were, but not underground. Large beautiful tubers hung from the branches like fruit.

These aerial tubers when planted yielded a new kind of underground potatoes which were more resistant and developed more quickly than those of which they were the offspring.

A still more fantastic discovery was the finding, among these second-generation hybrids, of three plants which bore both aerial and subterranean tubers at the same time. These tubers being harvested and planted yielded a stable new variety rather late in developing but delicious in flavor, extra large in size and very hardy.

One of the most recent experiments is the double grafting of belladonna and

tomato. Upon a tomato stem, a sprig of belladonna was grafted and then upon the latter again a tomato stem. It was found that the belladonna plant had by this operation lost its property of producing atropin poison which is normally found in all parts of the belladonna plant.

A series of experiments with chrysanthemums and other flowers showed that grafting caused flowers in many instances to yield a more pungent perfume, a fact of great importance to the perfume manufacturers of South France. Numerous trials with other plants are now being made of which the results have not yet been announced.

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SCIENTISTS OBSERVE ARMY OF CENTIPEDES ON THE MARCH

The migration of a vast army of "thousand-leggers", marching through the desert, is the unique sight reported in "Science" by Professors J. M. Thuringer and O. B. Jacobson of the University of Oklahoma.

They were driving through a desert stretch in New Mexico, devoid of vegetation or even of large rocks, when they observed small black objects along their path. At first they paid no attention to them, but when they became so numerous that the wheels of their Ford ran over one every yard they stopped long enough to examine them. They found that they were large centipedes, all apparently moving in the same direction. What these crawling beasts were doing in this desert place, where they came from, why they left their old home, and what they expected to find in a new one were questions the two scientists did not stop to ask.

"We thought of possible mishaps to our 'Lizzy'", they report, "the thirsty radiator and perhaps a forced stay in this most uninviting, inhospitable environment, and drove on. Fully ten more minutes were consumed in driving through this sea of centipedes, and countless victims remained behind in our tracks. We breathed a sigh of relief when the scattered outposts were reached and the burning sands alone reflected the heat of the brilliant desert sun."

Migrations of butterflies and other insects have been observed many times, but little or nothing is known about mass travel on the part of lower forms of life like centipedes.

WAVES IN STEEL CAUSE TURBINE WRECKS

Why steam turbines commit suicide has been discovered by General Electric Company engineers at Schenectady, New York. Ever since the war, mysterious failures and breakdowns in new-type turbines of high power and speed have been puzzling steam technicians. Apparently the most expert and careful calculations on the part of the designing engineers, and the most exact inspection of materials, were powerless to prevent pieces from flying out of the rim, and then, like monkey-wrenches in the works, playing hob with the internal machinery in general.

The investigation has shown that this suicidal tendency has been due to ex

strain placed on certain parts of the steel disks carrying the vanes or buckets by vibrational waves set up as an effect of rapid rotation. Just as a slow wind fans a flag into flapping waves, so the surface of a rapidly rotating disk, even though made of steel, can be thrown into slight troughs and furrows, and when these travel around the disk at a speed too near the rate of rotation of the disk itself, they set up strains too great for the material to bear, and the break occurs. The experiments here point the way for the elimination of many present difficulties with turbines, for by finding the natural rate of wave-vibration in a disk, and then seeing that the rotation is enough slower to neutralize it, the accumulation of strains to a potential breaking point can be avoided.

FOOD PALM RECOMMENDED FOR AMERICAN TROPICS

What the date is to Arabia and Egypt and the coconut to the Pacific islands, the Pejibaye palm is to thousands of Central and South Americans. This Costa Rican fruit with the strange-sounding name is being put forward by the Office of Foreign Seed and Plant Introduction of the Department of Agriculture, as a new and distinct possibility in tropical agriculture.

The fruit of the tree is borne in large clusters near the top. The individual fruits are somewhat topshaped, about the size of an apricot, and bright orange-yellow in color. Each has a single stony seed surrounded by a quantity of mealy pulp. This latter, when boiled, has the flavor and consistency of roasted chestnuts and is an excellent food. At the time of the Conquest, the Indians of Costa Rica subsisted almost exclusively upon pejiabayes during a certain part of each year. The fruit has become very popular among Costa Ricans of European blood, and brings a high price in the markets.

Government scientists are recommending the use of this fruit in the West Indies, Hawaii, the Philippines, and other possessions of the United States, as well as in tropical lands of other nations.

A closely related species from the Amazon Valley is called the "peach palm", and this name might well be extended to apply as a common English title to the Costa Rican tree as well.

GAS MILEAGE WASTED BY BAD ADJUSTMENTS

The average motor vehicle wastes about 30 per cent. of the heat value of the fuel through improper carburetor adjustment.

Such is the conclusion reached by scientists of the United States Bureau of Mines as the result of a study of the efficient utilization of gasoline. The figures were obtained largely by measuring and analyzing the exhaust gases. The waste was found in the production of incomplete combustion products - carbon monoxide, hydrogen, and methane.

Loss of heat value, the Bureau officials point out, means also loss of mileage. By properly adjusting the carburetors for maximum power and efficiency a large part of this heat loss can be eliminated. The experiments were carried on with a number of different fuels.

Among the practical conclusions reached by the Bureau are:

1. Change the carburetor adjustment when shifting from low test to high test gasoline.
2. Set the carburetors at a leaner adjustment for benzol fuels than for ordinary gasoline.
3. Use a preheater only when necessary, that is, only with gasoline which will not give satisfactory operation without preheated air during cold weather or for the first half hour after the engine has been started and before it is thoroughly warmed.

FINE JEWELRY FOUND IN OLD SAXON GRAVES

New light has been thrown on that dark period of English history which intervened between the departure of the Romans and the introduction of Christianity by the excavation of a remarkable Anglo-Saxon cemetery at Bidford-on-Avon by a group of British archeologists.

The ancient graveyard, discovered almost in the center of the village, contained more than 150 bodies and more than 200 urns in which human ashes had been deposited. The burials are believed to have been made between 500 and 560 A.D., just at the period when Christianity made its first appearance on the island. A few of the graves, it is possible, were those of Christians since they bear no evidences of the pagan religious rites with which the Saxons laid away their dead. The majority, however, slightly antedated the Christian period.

The warriors were buried with their weapons and the women with their jewelry. Strings of beads, composed of amber, paste, rock crystal and glass of various tints with an occasional Roman coin, were found worn in a festoon across the breast, the ends being suspended from a pair of ornamental pins or hung from the shoulder brooches, and not completely encircling the neck, as does the modern necklace. Bronze and silver finger rings were found, formed of flat bands of metal twisted into spirals. Among other jewelry was a beaver tooth mounted for use as a pendant, some finely cut and polished garnets delicately mounted in silver, ear-rings with two or three threaded beads, a neat cylindrical work box of bronze with a chain for attaching to the girdle, buckles of bronze and iron, bone combs, bronze-gilt wristlet clasps of various patterns, little sets of toilet implements on a ring, including bronze pins or toothpicks, ear picks and tweezers.

Many brooches also were found in pairs, resting on the collar bones or breast many of them of great size and typical of pre-Christian Anglo-Saxon art. One fine specimen measures five and a quarter inches in length and is ornamented with a maze of intricate design. It is heavily plated with gold which was as bright when dug up as when it was buried 1400 years ago. Such jewelry as this, claims Frederick C. Wellstood, F.S.A., one of the excavators, must raise the historical estimate of pagan Anglo-Saxon culture.

A railroad train was bodily overturned by a windstorm in India a short time ago.

FOREST PESTS AT WORK IN YELLOWSTONE PARK

The great forests of Yellowstone National Park, one of the chief glories of that wonderful region, are seriously endangered by the onslaught of two timber-killing insect pests. So far their ravages have been confined to areas so located that the beauty of the park has not been greatly marred, but unless vigorous and thorough measures are soon taken against them they will do irreparable damage

The first and probably more serious of these pests is the spruce budworm, which is at work in the Camp Roosevelt region, in the northeastern part of the Park. The larva of this insect feeds on the buds and leaves of spruce and fir trees, stripping them naked and leaving them to die. Its area of damage is rapidly eating into one of the most interesting and attractive forests, and dead trees will soon be seen along the roads.

The second pest is the sawfly, which attacks the lodgepole pine. This insect also is a defoliator, killing the leaves by chewing out the soft green parts and leaving a dead shell behind. Its operations are spreading through the forest along the road from the entrance at West Yellowstone, Montana, and will be especially in evidence next season when many of the trees will be dead.

As a means of keeping the epidemics in temporary check, spraying apparatus has been borrowed from the U. S. Forest Service, and poison sprays will be used for a distance of one thousand feet in either direction from the roads through the diseased areas. However, this is recognized by the Park Service authorities as only a relief and not a cure. For permanent results, more thorough measures, going wherever the pests have migrated, will have to be undertaken as soon as sufficient funds shall have been obtained.

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TABLOID BOOK REVIEW

OIL ENGINES. By A. L. Bird, M.A. Published by E. P. Dutton and Co., New York. Price \$5.00

Oil, as distinguished from the lighter products of petroleum such as gasoline, is finding an increasing use in engines for power plants and ships. As an authoritative and technical description of the operation of oil engines, particularly the Diesel type, this book will undoubtedly find a place in our technical literature.

The farmers in one township in the state of Washington have agreed to standardize their stock-raising by the adoption of one standard breed for each kind of animal handled.

Because of their cheerful, easy-going disposition, the Burmese have been dubbed the "Irish of the Orient".
